

**REMARKS****Claims Amendment**

Claim 13 is amended to incorporate the subject matter of Claim 33.

Claims 14 and 33 is cancelled.

Claim 34 is recast in an independent form.

**Applicants' Invention**

Applicants' invention is a proton-conducting electrolyte membrane obtained by a method recited in Claim 13. The steps include (a) expanding a polymer film with a liquid that contains a vinyl-containing phosphonic acid; and (b) polymerizing the vinyl-containing phosphonic acid present in the liquid of step (a), thereby forming an interpenetrating network of polyvinyl-phosphonic acid and the polymer.

Claims 13 specify that the product obtained in step (a) includes at least 50% by weight of vinyl-containing phosphonic acid. The recited process steps permit the final product to possess the intrinsic conductivity of the inventive membrane at 160°C is at least 0.001 S/cm. (See the English translation of the specification as filed: Table 1, page 41; Table 2, page 42; Table 3, page 43; Table 4, page 44; Table 5, page 45; Table 6, page 46; and Table 7a, page 47.)

In other words, the process steps recited in the base claims confer unexpected advantages on the proton-conducting electrolyte membrane obtained by the method recited in the base claims that could not have been predicted based on the cited references.

**Rejection of Claims 13-16, 18-22 and 33-34 under 35 U.S.C. §103(a) over U.S. 6,248,469 ("Formato")**

It is Applicants' understanding that in the Office Action of September 11, 2009, the Examiner withdrew the rejections under 35 U.S.C. §102 but maintained the rejection under 35 U.S.C. §103(a). The Examiner recapitulated the Office's legal position with respect to Formato and rejected Applicants' arguments. The Examiner stated that the argument with respect to presence of bulk regions with little or no ion-conducting material in Formato's membranes is

irrelevant since, according to the Examiner, the pending claims do not recite the presence of absence of these bulk regions (Office Action, page 8).

Applicants disagree with the Examiner.

Applicants previously argued that the substrate polymer of Formato is materially different from the polymer film of step (a) of Applicants' Claim 13, and that, therefore, the composite membranes resulting from the methods of manufacturing described by Formato are also materially different from the membrane of Claim 13.

Regarding the Examiner's statements concerning the bulk regions, Applicants submit that the presence of the bulk regions of no conductivity in the material of Formato is evidence that this material is not an *interpenetrating network*, which is an element of Applicants base claim. Accordingly, so long as one of ordinary skill in the art agrees that the bulk regions of no conductivity exist in Formato, one must also agree that the material of Formato is materially different from the material claimed by Applicants.

Furthermore, Applicants previously directed the Examiner to M.P.E.P. §2113, which states regarding product-by-process claims:

The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art [...] (*Emphasis added.*)

In other words, if the material formed as a result of performing the steps recited in Claim 13, as amended, is inevitably different from that of Formato, then the material of Claim 13, as amended, is patentably distinct. These inevitable material differences are not required to be recited in the claims. The Examiner's statements concerning the bulk regions appears to disregard the examination guidelines provided by M.P.E.P. §2113 since no weight is given to obvious material differences between the product inevitably formed as a result of the steps recited in the instant claims and the product described in the cited reference.

Applicants also direct the Examiner's attention to the decision of *In re Garnero*, 412 F.2d 276, 162 USPQ 221 (CCPA 1969), which is quoted in M.P.E.P. §2113. In *In re Garnero*, the court addressed the issue of patentability of a product-by-process claim in view of the art applied under 35 U.S.C. §103(a):

On appeal the solicitor's position appears to be that the only distinction between appellant's product and the products of the prior art is the process by which appellant's product is made [...] The solicitor is in effect reading claim 1 [...] as a product claim containing a process limitation [...] (412 F.2d 276 at 278).

The court rejected this approach:

The trouble with the solicitor's approach is that it necessarily assumes that claim 1 should be construed as a product claim containing a process, rather than structural, limitation. However, it seems to us that the recitation of the particles as "interbonded one to another by interfusion [...]" [...] is [...] capable of being construed as a structural limitation [...] (412 F.2d 276 at 279).

The court also gave clear guidelines for examination of a product-by-process claim:

The correct inquiry [...] is whether the product defined by claim 1 is patentably distinguishable over the [cited references] in view of the structural limitation [...] (*Ibid.*) (*Emphasis added.*)

Similar to *In re Garnero*, the product formed as a result of the steps recited in the instant claims is structurally different from the product described in the cited reference, as explained by Applicants. The Examiner, therefore, should inquire whether the structural differences between the product defined by the instant claims patentably distinguish this product from the cited references. As Applicants argued in this and previous responses, the product defined by the instant claims is patentably distinct from the product of Formato.

Reconsideration and withdrawal of the rejection are respectfully requested.

Rejection of Claims 13-16, 18-22 and 33-34 under 35 U.S.C. §103(a) over U.S. 6,607,856 ("Suzuki")

It is Applicants' understanding that in the Office Action of September 11, 2009, the Examiner withdrew the rejections under 35 U.S.C. §102 but maintained the rejection under 35 U.S.C. §103(a). The Examiner recapitulated the Office's legal position with respect to Suzuki and rejected Applicants' arguments distinguishing the material of Suzuki from the membranes of pending Claim 13. The Examiner stated that Suzuki exemplifies in Examples 18 and 19 the membranes having 10% by weight of vinyl-containing phosphonic acid. It is Applicants'

understanding that the Examiner implies that one of ordinary skill the art would find the membranes containing higher weight percent of vinyl-containing phosphonic acid obvious in view of Suzuki's teachings (Office Action, page 8). Regarding conductivity values, the Examiner took a position that mere silence by Suzuki on the conductivity values of the membranes of Examples 18 and 19 of Suzuki does not preclude these membranes from falling within the scope of Applicants' base claim.

Applicants submit that the membranes of pending Claim 13, as amended, are non-obvious in view of Suzuki because (a) the range of polyvinyl-containing phosphonic acid content in membranes of Claim 13 confers unexpected advantage of high-temperature conductivity onto Applicants' membranes and (b) Suzuki does not provide any motivation to raise polyvinyl-containing phosphonic acid content.

First, Applicants direct the Examiner to Suzuki, columns 29 and 30, Examples 18 and 19. Applicants note that phosphonic acid content in Example 18 is 9% by weight *before* washing and is 7% by weight after washing (col. 29, ll. 50 and 55). In Example 19, phosphonic acid content is even lower: 5% by weight before washing and 4% by weight after washing (col. 30, ll. 5 and 11).

Applicants also note that the materials of Suzuki belong to a class of proton-conductive materials different from those claimed by Applicants. The materials of Suzuki require the presence of water/moisture because the sulfonic acid moieties ( $-\text{SO}_3\text{H}$ ) are employed for conductivity and, as such, are "low temperature polymer electrolyte materials", which operate below  $100^\circ\text{C}$  and in the presence of water/moisture. At higher temperature, for example, at  $160^\circ\text{C}$ , no water/moisture is present, and the sulfonic acid moieties will no longer contribute to conductivity at this temperature. Conversely, the Applicants' materials utilize a different conductivity mechanism (so called "Grotthus Mechanism") and, therefore, are "high temperature polymer electrolytes", capable of operating above  $100^\circ\text{C}$ .

Applicants amended Claim 13 to recite that the product obtained in step (a) includes at least 50% by weight of polyvinyl-containing phosphonic acid. This is a significantly larger amount of the starting ingredient than in Suzuki. Accordingly, Applicants submit that the final product prepared by the steps recited in Claim 13 will also have higher phosphonic acid content than the product of Suzuki.

Secondly, the higher phosphonic acid content of the membranes prepared according to Applicants' Claim 13, as amended, possess the intrinsic conductivity at temperatures of 160°C is at least 0.001 S/cm. The membranes of Suzuki's Examples 18 and 19 do *not* have the recited high-temperature conductivity value. Submitted herewith is a Declaration by Dr. Schmidt Under 37 C.F.R. §1.132 (the "Declaration")<sup>1</sup>. The Declaration describes experiments that show that a proton-conducting membrane prepared by the method similar to that of Applicants' Claim 13, with the difference being that the polymer film used in step (a) was doped with only 9% by weight of polyvinyl-containing phosphonic acid, resulting in 7% by weight final doping ratio, possesses conductivity at 160 °C that is less than 0.00001 S/cm ( $10^{-5}$  S/cm). This value is *100 times* lower than the value recited in Applicants' Claim 13.

The Declaration, thus, demonstrates that where a membrane is prepared according to Applicants' methods, but such a membrane is only doped by a polyvinyl-containing phosphonic acid at the level described in Suzuki, this membrane does not possess an advantageous property of high-temperature conductivity.

In contrast, and as demonstrated by Examples 1-27 on pages 40-50 of the specification as filed, the Applicants' membranes possess high-temperature conductivity that is significantly above 0.001 S/cm.

Finally, Applicants note that in the membranes of Suzuki, phosphonic groups introduced by incorporating a polyvinyl-containing phosphonic acid serve a purpose different from Applicants'. Whereas in Applicants' membranes incorporation of a polyvinyl-containing phosphonic acid improves high-temperature conductivity, in membranes of Suzuki phosphonic acid groups serve as metal chelator groups (see Abstract and col. 4, ll. 43-51). Chelating metals, such as  $\text{Fe}^{2+}$  or  $\text{Cu}^{2+}$ , helps improve the service life of the membrane by inhibiting harmful peroxide-forming reaction (col. 1, ll. 38-48 and col. 4, ll. 26-36). Furthermore, Suzuki is silent on the contribution to conductivity by the phosphonic acid and does not teach that raising the phosphonic acid content is beneficial for any other purpose. Higher concentration of phosphonic acid is not needed for chelating metals. Accordingly, based on Suzuki, one of ordinary skill in

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<sup>1</sup> Applicants enclose an unsigned copy of the Declaration. The Declaration signed by Dr. Schmidt will be filed by a supplementary response as soon as it is available.

the art would not be motivated to increase the content of a polyvinyl-containing phosphonic acid to the levels recited in Applicants' Claim 13, as amended.

In view of the above, the membranes of Applicants' Claim 13, as amended, and claims dependent thereon are not only novel in view of Suzuki but are also non-obvious.

Reconsideration and withdrawal of the rejection are respectfully requested.

#### Double-Patenting

##### (1) U.S. App. No. 10/506,622

Claims 13-16, 18-22, and 33-34 are being provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over Claims 20-26, 28-31, and 41-50 of co-pending U.S. App. No. 10/506,622.

This is a provisional rejection. This rejection should be withdrawn when the claims in the present application are found to be otherwise patentable and U.S. App. No. 10/506,622 is still in prosecution. In the event U.S. App. No. 10/506,622 is found allowable while the claims pending in the present case are still in prosecution, a Terminal Disclaimer under 37 C.F.R. §1.321(c) will be filed upon notification that the pending claims are otherwise allowable.

##### (2) U.S. App. No. 10/506,387

Claims 13-16, 18-22, and 33-34 are being provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over Claims 20-26, 28-31, and 41-50 of co-pending U.S. App. No. 10/506,387.

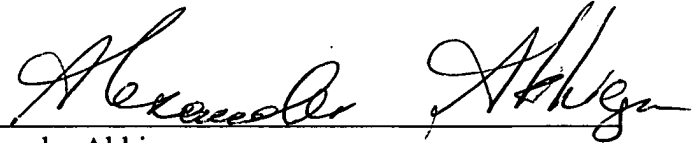
This is a provisional rejection. This rejection should be withdrawn when the claims in the present application are found to be otherwise patentable and U.S. App. No. 10/506,387 is still in prosecution. In the event U.S. App. No. 10/506,387 is found allowable while the claims pending in the present case are still in prosecution, a Terminal Disclaimer under 37 C.F.R. §1.321(c) will be filed upon notification that the pending claims are otherwise allowable.

**CONCLUSION**

In view of the above remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

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